

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Issued August 20, 1907..

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY.—CIRCULAR 114.

A. D. MELVIN, CHIEF OF BUREAU.

SANITARY MILK PRODUCTION.

REPORT OF A CONFERENCE APPOINTED BY
THE COMMISSIONERS OF THE DISTRICT OF
COLUMBIA, WITH ACCOMPANYING PAPERS.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1907.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., July 9, 1907.

SIR: I have the honor to transmit herewith, and to recommend for publication as a circular of this Bureau, a series of papers and reports dealing with sanitary milk production, prepared by a conference appointed by the Commissioners of the District of Columbia to consider and report upon the local milk supply, to advise what steps should be taken to improve it, and to suggest legislation to that end. As the subject of a wholesome milk supply is one of great interest and importance to the public, not only in the city of Washington but in many other cities and sections of the country where similar problems exist, the publication of the accompanying papers by this Department is considered very desirable.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
Report of the milk conference appointed by the Commissioners of the District of Columbia.....	5
Diseases and conditions of cattle that may affect the quality of the milk. By John R. Mohler.....	12
Milk sediments or dirty milk in relation to disease. By George M. Kober....	18
Sanitary inspection of dairies and distributing depots. By Ed. H. Webster..	22
The water supply of dairy farms. By G. Lloyd Magruder.....	24
Milk during transportation. By Emile Berliner.....	27
Commercial classes of milk. By A. D. Melvin.....	29
Pasteurization. By M. J. Rosenau.....	30
Report of the committee to consider the sanitary aspects of the milk supply..	31
Report of the committee to consider the milk supply in its relation to the feeding of infants.....	36
Report of the committee on the control of the milk supply from an administrative standpoint.....	37

[Cir. 114]

LIST OF MEMBERS OF THE MILK CONFERENCE.

- Gen. George M. Sternberg, chairman; professor of hygiene, department of public health, George Washington University.
- Dr. George M. Kober, first vice-chairman; professor of hygiene, school of medicine, Georgetown University.
- Dr. Harvey W. Wiley, second vice-chairman; Chief of the Bureau of Chemistry, United States Department of Agriculture.
- Dr. William C. Woodward, secretary; health officer of the District of Columbia.
- Mr. Emile Berliner.
- Dr. Charles A. Davis, president of the Washington Homeopathic Medical Society.
- Mr. John P. Earnest.
- Mr. George B. Farquhar, president of the Milk Dealers' Association.
- Mr. Peter Fireman, president of the Chemical Society of Washington.
- Dr. D. Percy Hickling, chairman of the committee on prevention of consumption, Associated Charities.
- Mr. Firman R. Horner, milk producer, Washington, D. C.
- Dr. H. L. E. Johnston.
- Dr. J. W. Kerr, Assistant Surgeon-General, United States Bureau of Public Health and Marine-Hospital Service.
- Dr. G. Lloyd Magruder.
- Dr. C. F. Mason, Assistant Surgeon-General, United States Army.
- Mr. William F. Mattingly, president of the Bar Association of the District of Columbia.
- Dr. A. D. Melvin, Chief of the Bureau of Animal Industry, United States Department of Agriculture.
- Dr. John R. Mohler, chief of the Pathological Division, Bureau of Animal Industry, United States Department of Agriculture.
- Capt. Charles Newbold.
- Mr. George M. Oyster, jr., milk producer, Washington, D. C.
- Mr. James F. Oyster, president of the Business Men's Association.
- Brig. Gen. Robert M. O'Reilly, Surgeon-General United States Army.
- Dr. Robert Reyburn, professor of hygiene, Howard University.
- Admiral P. M. Rixey, Surgeon-General United States Navy.
- Dr. M. J. Rosenau, Director Hygienic Laboratory, United States Bureau of Public Health and Marine-Hospital Service.
- Dr. E. C. Schroeder, Superintendent of Experiment Station, Bureau of Animal Industry, United States Department of Agriculture.
- Dr. D. K. Shute, president of the Medical Society of the District of Columbia.
- Col. Robert G. Smith, milk producer, Alexandria, Va.
- Dr. W. M. Sprigg, chairman of the milk commission, Medical Society of the District of Columbia.
- Dr. E. R. Stitt, surgeon, United States Navy.
- Mr. John Thomas, president of the Milk Producers' Association.
- Mr. E. H. Thomas, corporation counsel of the District of Columbia.
- Mr. C. D. Walcott, president of the Washington Academy of Sciences.
- Mr. Ed. H. Webster, chief of the Dairy Division, Bureau of Animal Industry, United States Department of Agriculture.
- Gen. J. M. Wilson, president of the Washington Board of Trade.
- Dr. Hulbert Young, president of the District of Columbia Veterinary Medical Association.

SANITARY MILK PRODUCTION.

REPORT OF THE MILK CONFERENCE APPOINTED BY THE COMMISSIONERS OF THE DISTRICT OF COLUMBIA.

The conference called by the Commissioners to deliberate with respect to the milk supply of the District of Columbia, and to advise the Commissioners what future steps should be taken to improve said milk supply, and what amendment should be made to the Commissioners' bill for the better regulation of the milk business, respectfully submits the following report:

The conference has had numerous meetings, and through the committees appointed for that purpose has collected information bearing upon the sanitary aspects of the milk supply, and particularly upon the sanitary aspects thereof in so far as they relate to infant life and to the relations existing between milk and the causation of typhoid fever, diphtheria, scarlet fever, and other communicable diseases. And through other committees the conference has collected information with respect to the commercial aspects of the milk business, and upon the supervision and control thereof by the Government. The reports of these several committees are appended hereto.^a

It is unnecessary, particularly in view of the extensive and detailed information embodied in the appended committee reports, to describe here at any length the sanitary importance of milk as an article of diet. Here and elsewhere throughout the report when the word "milk" is used it is to be accepted as including all forms of milk, unless it would be manifestly improper to do so, and as including cream. And for the sake of brevity, and to avoid repetition, it may be said here that generally the facts and principles relating to and governing the sanitary features of the milk supply are applicable, other things being equal, to ice cream.

CLASSIFICATION OF MILK.

In order that the milk supply of the District may be pure, it must come from healthy cows, properly fed, that are neither about to calve nor have recently calved. The milk from these cows must be drawn

^a As the report of the committee on the commercial aspects of the local milk supply deals mostly with local conditions, it has been omitted from this circular.

in a cleanly manner and be promptly cooled. All persons engaged in handling milk must be free from communicable diseases and of cleanly habits. All receptacles into which the milk passes and all utensils and apparatus used in handling it must be perfectly clean, and the milk after having been promptly cooled must be kept cool until delivered to the consumer. Actually to attain ideal conditions with respect to milk is difficult and expensive, and adds materially to the cost of the milk, and therefore to the selling price. But to undertake earnestly to approximate such conditions is less difficult and less expensive, and for practical purposes may be regarded as yielding a reasonably satisfactory and reasonably safe milk.

The conference recommends that there be recognized by law three grades of milk, as follows:

Class 1. Certified milk.—The use of this term should be limited to milk produced at dairies subjected to periodic inspection and the products of which are subjected to frequent analyses. The cows producing such milk must be properly fed and watered, free from tuberculosis, as shown by the tuberculin test, and from all other communicable diseases, and from all diseases and conditions whatsoever likely to deteriorate the milk. They are to be housed in clean stables, properly ventilated, and to be kept clean. All those who come in contact with the milk must exercise scrupulous cleanliness, and such persons must not harbor the germs of typhoid fever, tuberculosis, diphtheria, and other infections liable to be conveyed by the milk. Milk must be drawn under all precautions necessary to avoid infection, and be immediately strained and cooled, packed in sterilized bottles, and kept at a temperature not exceeding 50° F. until delivered to the consumer. Pure water, as determined by chemical and bacteriological examination, is to be provided for use throughout the dairy farm and dairy. Certified milk should not contain more than 10,000 bacteria per cubic centimeter, and should not be more than 12 hours old when delivered. Such milk shall be certified by the health officer of the District of Columbia.

Class 2. Inspected milk.—This term should be limited to clean raw milk from healthy cows, as determined by the tuberculin test and physical examination by a qualified veterinary surgeon. The cows are to be fed, watered, housed, and milked under good conditions, but not necessarily equal to the conditions provided for class 1. All those who come in contact with the milk must exercise scrupulous cleanliness, and such persons must not harbor the germs of typhoid fever, tuberculosis, diphtheria, and other infections liable to be conveyed by the milk. This milk is to be delivered in sterilized containers, and is to be kept at a temperature not exceeding 50° F. until it reaches the consumer. It shall contain not more than 100,000 bacteria per cubic centimeter.

Class 3. Pasteurized milk.—Milk from the dairies not able to comply with the requirements specified for the production of milk of classes 1 and 2 is to be pasteurized before being sold, and must be sold under the designation “pasteurized milk.” Milk for pasteurization shall be kept at all times at a temperature not exceeding 60° F. while in transit from the dairy farm to the pasteurization plant, and milk after pasteurization shall be placed in sterilized containers and delivered to the consumer at a temperature not exceeding 50° F. All milk of an unknown origin shall be placed in class 3 and subjected to clarification and pasteurization. No cow in any way unfit for the production of milk for use by man, as determined upon physical examination by an authorized veterinarian, and no cow suffering from a communicable disease, except as specified below, shall be permitted to remain on any dairy farm on which milk of class 3 is produced, except that cows which upon physical examination do not show physical signs of tuberculosis may be included in dairy herds supplying milk of this class, although they may have reacted to the tuberculin test.

This milk is to be clarified and pasteurized at central pasteurization plants, which shall be under the personal supervision of an officer or officers of the health department. These pasteurizing plants may be provided either by private enterprise or by the District Government, and shall be located within the city of Washington.

By the term “pasteurization,” as used herein, is meant the heating of milk to a temperature of 150° F. or 65° C. for 20 minutes, or 160° F. or 70 C. for 10 minutes, as soon as practicable after milking, in inclosed vessels, preferably the final containers, and after such heating immediate cooling to a temperature not exceeding 50° F. or 10° C.

No milk shall be regarded as pure and wholesome which, after standing for two hours or less, reveals a visible sediment at the bottom of the bottle.

No dairy farm shall be permitted to supply milk of a higher class than the class for which its permit has been issued, and each dairy farm supplying milk of a specified class shall be separate and distinct from any dairy farm of a different class; the same owner, however, may supply different classes of milk, providing the dairy farms are separate and distinct, as above indicated.

SUPERVISION OF THE MILK SUPPLY.

In order that the sale of milk in the District of Columbia may be properly supervised, the conference recommends as follows:

1. *Regulations.*—That the Commissioners be empowered to make, on the recommendation of the health officer, all such regulations as may be necessary, in their judgment, to safeguard the milk supply of the District of Columbia.

2. *Increase of inspection force.*—That for the purpose of supervision of dairy farms and of the production of milk, inspectors, in addition to the chief inspector hereinafter mentioned, be provided in proportion of at least 1 for every 100 licensed dairy farms, and for the purpose of supervising the handling and sale of milk in and about the city the number of inspectors be not less than 3.

3. *Qualifications and duties of inspectors.*—That all inspectors be selected because of their special fitness for the work that they are to perform. Not less than one-half of the inspectors of dairy farms should be veterinary surgeons. Appointments should be made by the Commissioners, on recommendation of the health officer, and removals made at the discretion of the Commissioners. The exact duties and limits of the jurisdiction of each inspector should be fixed, and the work of the inspectors should be supervised by the chief inspector appointed for that purpose, under the direction of the health officer. Every inspector should devote his entire time to the performance of his official duties.

4. *Salaries of inspectors.*—That salaries be paid commensurate with the technical skill and experience of the inspectors, to be in the case of the chief inspector not less than \$2,000 per annum, with traveling expenses, and in the case of the other inspectors not less than from \$1,600 to \$1,800 per annum, with traveling expenses.

5. *Increase of laboratory facilities.*—That in connection with the health department there be provided facilities for the making of such chemical and bacteriological analyses of milk, and of water from dairy farms and from other places where milk is handled and sold, and for the making of such chemical and bacteriological analyses generally, as in the judgment of the health officer may be necessary.

6. *Increase of clerical assistance.*—That such additional clerical assistance be provided as may be required to meet the increased demands upon the clerical force of the health department that will result if the recommendations of this conference be adopted.

7. *Establishment of pasteurizing plant.*—That there be established by private enterprise if possible, and otherwise by the District Government, plants for the pasteurization of milk under the immediate supervision of the health department.

8. *Revocation of licenses by health officer.*—That the health officer be empowered to suspend and to revoke summarily any license to produce or sell milk in the District, and any license to bring milk into the District, if the holder of any such license violates any of the laws or regulations governing the production and sale of milk or the bringing of milk into the District, in such a manner as, in the judgment of the health officer, to endanger the health of persons consuming the milk produced, sold, or brought in by the holder of such permit.

9. *Revocation of licenses by inspectors.*—That any authorized inspector in the service of the health department duly charged with the inspection of places where milk is produced, handled, or sold be empowered to suspend summarily for a period not exceeding forty-eight hours any license to produce or to sell milk in the District, and any license to bring milk into the District, if the holder of such license violates any of the laws or regulations governing the production and sale of milk, or the bringing of milk into the District, in such a manner as, in the judgment of such inspector, to endanger the health of persons consuming the milk produced, sold, or brought in by the holder of such license; provided, that any inspector who willfully fails in the proper discharge of his duty, or who knowingly makes any false report, or who willfully and maliciously and without probable cause threatens to suspend or suspends the license of any producer or dealer in milk, shall be guilty of a misdemeanor, punishable by a fine, or by imprisonment, or by both.

10. *Identification of dairy cattle.*—That all cows on dairy farms producing milk for the District of Columbia be tagged, tattooed, or otherwise marked for purposes of identification.

11. *Tuberculin testing or pasteurization required.*—That all milk produced for use in the District of Columbia shall either come from cattle free from tuberculosis as shown by the tuberculin test, which tuberculin test shall be repeated at least once every year, or be subjected to pasteurization under the supervision of the health department in case the herd is not tuberculin tested.

12. *New dairy cattle to be tuberculin tested.*—That hereafter no addition shall be made to any herd producing milk for use in the District of Columbia, whether such herd has or has not been tuberculin tested, unless the cattle so added have been tested with tuberculin and found to be free from tuberculosis.

13. *New licentiates to have herds tuberculin tested.*—That hereafter no license shall be granted to produce milk for use in the District of Columbia unless the herd by which such milk is to be produced has been found by the tuberculin test to be free from tuberculosis.

14. *Milk from diseased cattle not to be sold.*—That the milk of cattle suffering from any disease of the udder, or suffering from anthrax, rabies, gastro-enteritis, septic conditions, or clinical symptoms of tuberculosis, shall not be utilized as human food, even though the milk be pasteurized. Nor shall milk taken from cows during the period beginning fifteen days before and ending five days after parturition, or from cows receiving any deleterious medicament or feedstuff, be, even though pasteurized, used as food for human beings.

15. *Physical examinations of dairy cattle.*—That the veterinary inspectors of the health department make frequent visits to dairy

farms having untested herds so as to discover as early as possible all advanced cases of tuberculosis (clinical cases of tuberculosis), and particularly tuberculosis affecting the udder.

16. *Water supply of dairy farms and dairies.*—That particular attention be given to the water supply of dairy farms and of dairies, with special reference to the location and construction of such wells, cisterns, and springs as are used in connection with the business.

17. *Equipment of dairies and dairy farms.*—That every dairy farm and every dairy be equipped with all necessary appliances for cleaning and scalding or otherwise sterilizing all receptacles, utensils, and apparatus used for the handling of milk, and with all necessary appliances properly to cool and to keep cool milk awaiting delivery.

18. *Definition of "dairy," and general restrictions with respect thereto.*—That every place where milk is sold be deemed a dairy for all purposes whatsoever, and that the sale of milk in grocery stores, bakery shops, and other similar places be prohibited, except when the milk is sold and delivered in the original package in which it has been received. The production of milk for sale and the sale of milk, wherever conducted, should be maintained absolutely and entirely apart from all household operations.

19. *Delivery of milk in bulk.*—That all receptacles containing milk in quantities exceeding one quart, for delivery to customers, be sealed in a manner satisfactory to the health officer before being placed upon the delivery wagon, and be kept so sealed until after delivery, except as it may be necessary to open them for the purpose of official inspection and sampling.

20. *Method of collecting samples.*—That whenever a sample of milk is collected for analysis the inspector shall divide the sample into two parts, placing each part in a proper container and sealing such container with a proper seal, and then deliver one such sealed container to the vendor for such purposes as he may desire, the dividing, bottling, and sealing of the samples to be done when practicable in the presence of the vendor or his agent.

21. *Condemnation of milk.*—That immediate seizure and denaturing with some odorous substance or coloring matter of milk found to contain preservatives, or to be in such condition as to render its sale unlawful, be authorized by law.

22. *Publication of results of examinations and analyses.*—That, at least pending the time which must necessarily elapse before the production of certified milk is begun on a commercial scale, the health officer be authorized to publish, from day to day, as a result of his inspections, a list of dairies and dairy farms from which the milk supply is drawn, giving the rating of each dairy and of each dairy farm, and the chemical composition and bacterial count of each sample of milk analyzed.

23. *Certification of milk.*—That the health officer be authorized to advertise for dairies and dairy farms, the proprietors of which may be willing so to modify their barns, stables, etc., if necessary, as to procure a certificate from him showing that they are producing what is hereinbefore described as certified milk.

24. *Modified milk.*—That for the purpose of procuring modified milk for infants and for persons in ill health, according to the prescriptions of physicians, the milk commission of the Medical Society of the District of Columbia be requested to procure the establishment of a laboratory under its supervision in which only certified milk shall be used and in which, by the use of a separator, or otherwise, milk of a definite chemical composition may be obtained from certified milk in harmony with the physicians' prescriptions relating thereto.

25. *Refrigerator-car service.*—That an effort be made to procure the establishment of a refrigerator-car service for the transportation of milk into the District of Columbia from May 1 to December 1, and to provide for cooling rooms or devices at all stations where milk is held awaiting the arrival of milk trains.

DUTIES OF CONSUMERS.

1. *Use of certified milk to be urged.*—That parents and guardians be urged to use only certified milk, at least as the food for infants under the age of 3 years.

2. *Popular education with reference to sanitary relations of milk.*—That systematic instruction with reference to the sanitary relations of milk as an article of diet, and of other foods, be made a part of the curriculum of the public schools of this District; that popular articles be frequently prepared for the press; that lectures and demonstrations be given; that pamphlets in plain language be prepared by the health officer for general distribution, and that rules and suggestions accompanied by statements of the reasons therefor be placed in the hands of dairymen and dairy attendants.

3. *Home inspection of milk.*—That consumers of milk be urged to patronize no milk dealer whose milk after standing for two hours or less reveals a visible sediment at the bottom of the bottle, as such a sediment is evidence of dirty habits, extremely suggestive of danger, and entirely preventable by clean, decent methods, without greatly increasing the cost of the milk. The consumer should furthermore subject the milk that he receives, unless it come from a tuberculin-tested herd and from a source otherwise above suspicion, to a process of purification by bringing it to the boiling point, cooling it immediately, and thereafter keeping it on ice.

In conclusion, the conference desires to say that it fully recognizes the fact that the efforts that are now being made to improve the milk supply may lead to an increase in the price of milk, but the conference

feels that if the increase in the cost is accompanied, as presumably it will be, by a diminution in the dangers that now accompany the use of milk, no one should begrudge the money spent for the safety to life and health that results therefrom.

The conference will carefully consider the legislation heretofore proposed by the Commissioners for the improvement of the milk supply and will suggest to the Commissioners, at a later date, such modifications thereof as seem to the conference desirable.

DISEASES AND CONDITIONS OF CATTLE THAT MAY AFFECT THE QUALITY OF THE MILK.

By JOHN R. MOHLER, A. M., V. M. D.,

Chief of the Pathological Division, Bureau of Animal Industry.

IMPORTANCE OF A WHOLESOME MILK SUPPLY.

The importance of obtaining a hygienic and wholesome milk supply is recognized by all intelligent people and should require no argument. Public health demands the purity of all milk and milk products. Next to bread, milk is more extensively used as an article of diet than any other foodstuff. It forms a portion of the food of almost every person on practically every day of the year. Moreover, unlike many other articles of diet, milk is consumed in most cases in an uncooked state, making it a very dangerous food should it perchance contain any deleterious organisms. The reasons for securing a supply of pure and wholesome milk are so numerous and so important that the consumer should become acquainted with some of the more essential of them in order that he may render assistance in bringing about a satisfactory improvement.

Not only is milk a very suitable medium for almost every description of germ life which may gain access to it in its journey from the cow to the consumer, but it may also become contaminated while still in the udder through infectious or poisonous material present in the cow herself. Consideration in this report will be given only to the latter aspect of the question of a wholesome milk supply. In this connection it will be necessary to keep in mind the requirements of an awakened public for a clean and wholesome milk, as well as the effect of any unreasonable or irrational demand upon the producer which may cause him heavy losses or even to discontinue his business.

It will also be apparent that in order to produce milk in compliance with the requirements hereafter to be described, certain precautions must be taken which will necessarily entail additional expense upon the producer of this higher grade of milk. The customer must, therefore, expect to pay his portion of any legitimate advance in the cost of production, and such increase in the price of milk due to its improved quality should be considered as money well expended.

Furthermore, we can not have good milk of safe quality without a realization on the part of the farmer, the transportation agent, the dairyman, and the housewife of the danger in utilizing old, warm, or dirty milk. Education is, therefore, an important factor in the improvement of the milk supply, which can not be accomplished through laws and regulations alone. In view of these facts, it is recommended that the subject be taught in the schools, that popular articles be frequently prepared for the press, that lectures and demonstrations be given in towns and townships, that pamphlets in plain language be prepared by the health officer for general distribution, and especially that rules and suggestions, with reasons therefor, be placed in the homes of dairymen and dairy attendants.

MILK FROM UNHEALTHY COWS AS A FACTOR IN THE SPREAD OF DISEASE.

TUBERCULOSIS.

Probably the most important disease of cows from the standpoint of public health is tuberculosis, and it is also the most prevalent. When Koch first discovered the cause of the disease and combined the announcement of his discovery with the statement that he considered the affection identical in both man and bovine, it was accepted by scientists as well as by the general public. His subsequent announcement in 1901, to the effect that this disease was different in man and in cattle, and that there was no practical need for preventing the use of the products of tuberculous animals for human food, was the cause of much rejoicing among those who were only too glad to grasp at any idea which would tend to separate the disease in man and in cattle, forgetting that bovine tuberculosis is also a dangerous disease to other cattle in the herd and should be stamped out for this reason, aside from the danger to which man is exposed.

As a result of this radical statement of Koch's, which was based upon incomplete and unsatisfactory evidence, several government commissions were appointed in different countries, and many private and public scientists immediately took it upon themselves to solve the question raised by that investigator. The results of these experiments were so strikingly similar that it is now the generally accepted opinion among scientists that people, especially children, may become infected with tuberculosis from cattle. It is not known to what extent such infection occurs, nor is it possible to obtain any definite percentage by the method formerly adopted of looking for the primary lesions in the intestinal canal, although much statistical evidence is recorded showing that even by these figures primary intestinal tuberculosis of children has been observed in as high as 45.5 per cent of the tuberculous cases examined. (Heller.) Evidence which must be considered conclusive has been obtained by the Bureau of Animal Industry, as well as by Ravenel and a number of French investigators, showing that tuberculous infection may take place through the intestinal tract without leaving any lesion in the abdominal cavity, the first alteration being found in the lungs or the thoracic glands. Therefore the presence of pulmonary tuberculosis in infants without intestinal lesions is no indication that the disease was not transmitted by the food, and the statistics above referred to are thus shown to be below the true percentage of cases of tuberculosis of intestinal origin.

These figures, however, do not give any satisfactory idea as to whether the bacilli entering the intestines originated from human or bovine sources. Owing to this fact, it follows that the only way of determining the infection of people by bacilli of the bovine type will be to study the lesions in the body of as many cases of human tuberculosis as is possible. Already we have sufficient data to give us some idea of the extent of tuberculosis of the bovine type in children without considering the numerous cases of direct transmission recorded by many physicians, especially of instances of butchers and others receiving accidental infections of the skin with the bovine organism. Moreover, according to Von Behring, the question of infection in man usually goes back to childhood, as he believes that many of the cases of pulmonary tuberculosis in adults is of intestinal origin, infection having occurred primarily through the intestinal tract by drinking tuberculous milk during infancy and having remained latent until adult life.

The finding of the bovine type of tubercle bacillus in human lesions is the most direct and positive proof that tuberculosis of cattle is responsible for a certain amount of tuberculosis in the human family. Numerous experiments with this object in view have already proven this fact. Thus the German Commission on Tuberculosis examined 16 different cultures obtained from tubercular lesions in children and found 4 which were more virulent than is usual for human tubercle bacilli, causing

tuberculosis in the cattle inoculated with them, and making 25 per cent of the cases tested that were affected with a form of tuberculosis which, by Koch's own method, must be classified as of bovine origin. In a similar series of tests conducted by the British Royal Commission on Tuberculosis 60 cases of the disease in the human were tested, with the result that 14 cases were claimed by this commission to have been infected from bovine sources. Ravenel reports that of 5 cases of tuberculosis in children 2 received their infection from cattle. Theobald Smith has also reported on one culture of the bovine tubercle bacillus obtained from the mesenteric glands of a child out of 5 cases examined, and according to a recent paper by Goodale, Smith has recently been at work on 7 other cultures from different children, 4 of which conformed to his idea of tubercle bacilli emanating from cattle. Of 4 cases of generalized tuberculosis in children examined in the Biochemic Division of the Bureau of Animal Industry, 2 were found to be affected with very virulent organisms, which warranted the conclusion that such children had been infected from a bovine source. The Pathological Division of the same Bureau has likewise, out of the 9 cases of infantile tuberculosis examined, obtained two cultures of tubercle bacilli that could not be differentiated from bovine cultures. In Europe so many similar instances of bovine tubercle bacilli having been recovered from human tissues are on record that it appears to your committee entirely proven that man is susceptible to tuberculosis caused by animal infections, and while the proportion of such cases can not be decided with even approximate accuracy, it is nevertheless incumbent upon us to recommend such measures as will guard against these sources of danger when enforced.

The two principal sources of infection from cattle, and the only ones necessary to be considered, are the meat and milk of tuberculous animals. The fact that most of the cases of bovine tuberculosis above enumerated which occurred in the human were cases of infantile tuberculosis points with grave suspicion to the milk rather than the meat supply. This naturally leads to the question of how and under what condition does the milk become infectious. That milk coming from a tuberculous udder is capable of transmitting the infectious principle is conceded by all who have given the subject any consideration. It has been equally established that in advanced generalized tuberculosis the udder may secrete tubercle bacilli without showing any indication of being affected. Careful experiments performed by trained and eminently responsible investigators have also demonstrated beyond reasonable doubt that tubercle bacilli at certain times may be present in the milk of cows affected with tuberculosis to a degree that can be detected only by the tuberculin test, so that in a herd of cows in the various stages of tuberculosis it is to be expected that some of them will secrete tuberculous milk, which, when mixed with other cows' milk, makes the entire product dangerous. It has been shown by Eber in Germany and Schroeder in this country that, even when the tubercle bacilli are not being excreted by the udder, the dust and manure of the stable where the diseased animals are kept are in many cases contaminated with tubercle bacilli. This contaminated material may readily infect the milk during the process of milking, even though the milk comes from a healthy cow. The importance of this method of infecting milk can not be too greatly emphasized, when it is known that cattle in prime condition without any udder lesions and with but slight alterations in the lungs frequently raise tuberculous mucus into the pharynx while coughing, then swallow this material, and thus contaminate the feces. In a recent examination at the Bureau of Animal Industry Experiment Station of the manure passed by 12 cows just purchased from dairy farms in this city and affected with tuberculosis to an extent only demonstrable by the tuberculin test, tubercle bacilli were found in over 41 per cent of the cases, both by microscopic examination and animal inoculations. The danger from this method of infecting milk is impressed upon us as consumers when we realize that on an average probably 25 per cent of all the cows

which supply milk to the District are tuberculous, and this is considered to be a conservative estimate, judging from the results of recent tuberculin tests.

Vital statistics show that 14 out of every 100 people that die succumb to tuberculosis, while of the remaining 86 more than one-half show lesions of tuberculosis on post-mortem, although dying from some other cause. The statement of Von Behring, above mentioned, is particularly pertinent in regard to the relation of human tuberculosis to the milk supply, especially in connection with the results of those investigators who have studied market milk and found from 5.2 to 55 per cent of the samples examined to contain tubercle bacilli. Le Blanc considers the milk of tuberculous cows dangerous even when bacilli are not present, on account of the toxin it contains. Michellazzi has injected such milk into tuberculous animals and obtained a reaction.

To eliminate all tuberculous cattle from the herd, or to pasteurize all milk coming from untested cattle, should therefore be the object of all producers of milk, and the sanitarians will be remiss in their whole duty should they neglect to guard against the products of tuberculous animals in their attempts to eradicate tuberculosis from man.

ACTINOMYCOSIS.

This disease, while not at all infrequent in the maxillary regions of cattle, is quite rarely located in the udder. It is readily mistaken for tuberculosis, owing to the diffuse lesions and the character of the pus. While no known case of actinomycosis in man has been traced to the milk, it is nevertheless advisable to condemn the milk from an infected udder, especially since the virus of the disease in man, in most cases, has been found to enter the body through the alimentary canal. Furthermore, there is usually in actinomycosis a mixed infection with pus-producing cocci, which emphasizes the necessity for prohibiting the use of the milk from such udders.

BOTRYOMYCOSIS.

Botryomycosis of the udder is only occasionally met with, but when it is observed, the utilization of the milk therefrom should not be permitted. The disease is chronic and is accompanied by new connective tissue formation and burrowing sinuses from which pus escapes. Mixed infection is liable to occur in this disease also, which adds to the danger of consuming the milk.

FOOT-AND-MOUTH DISEASE.

This affection is transmissible to man through the consumption of milk from diseased animals, but, fortunately, the disease has been eradicated from this country, and it is to be hoped that this contagion will never require any serious consideration from the sanitarians of the United States in the future.

ANTHRAX.

In this disease the milk has an abnormal appearance and decomposes rapidly. The bacterium of anthrax has been recovered from milk fourteen days after it had been taken from an infected cow, which illustrates the importance of prohibiting the use of milk from such animals.

COWPOX.

This disease, which is probably becoming more common in this country, renders the milk unfit for food, and its distribution from cows so affected should not be permitted, inasmuch as the milk may become contaminated from the pustules and ulcers on the teats and in the sinuses of the udder, and produce infection by the alimentary canal of young children if it is consumed in a raw state.

The appearance of dark brown crusts on the teats and udders of cattle is suggestive of several conditions and should be carefully examined, particularly since the isolation by Dean and Todd of an organism identical with the Klebs-Loeffler bacillus from such lesions as well as from the milk. Diphtheria is not a disease of cattle, but it is possible for an abrasion to become infected with this organism from a human origin and the local lesion spread until it involves the milk sinuses. It was also suggested that this udder lesion might be due to an infected milker following the all too common habit of spitting on his hands before commencing to milk and the bacillus passing up the milk duct might thereby infect the sinus.

RABIES.

The virus of rabies has in several instances been reported to have been passed to the offspring through the mother's milk. While it is not probable that cattle would be milked after the symptoms of rabies developed, it is nevertheless important to realize the danger of using such milk and the necessity for preventing calves from sucking such diseased cows.

MAMMITIS, MASTITIS, OR GARGET.

This disease, or series of diseases, of the udder is by far the most frequent alteration noted. Usually only one quarter is affected, although the whole udder may at times be involved. The affected parts are greatly swollen and more or less painful in the early stages. The milk, at first normal in appearance, soon changes its character, becoming watery, light brown in color, and in some cases contains flocculi and pus cells and appears tenacious, slimy, orropy. The cause of this condition is usually a streptococcus, although staphylococci are frequently incriminated in suppurative conditions of the udder, especially where abscess formation occurs. The milk from such an udder is objectionable from an esthetic standpoint and is also liable to give rise to gastro-intestinal disorders, especially in children. Such milk should be prohibited until the inflammatory condition entirely disappears.

GASTRO-ENTERITIS.

The milk of cows affected with gastro-enteritis is of an abnormal character, being watery, of bitter taste, and changes quickly to a "sweet curdle." This milk is liable to produce digestive disturbances in the consumer and should not be utilized.

SEPTIC OR FEBRILE CONDITIONS.

The presence in the dairy of cows affected with such septic conditions as puerperal sepsis, septic metritis, diffuse phlegmon, suppurative wounds, and extensive ulcerations constitutes a grave danger to the milk supply, inasmuch as the milk may become infected with the pus-producing organisms, among which the streptococci are capable of causing enteritis in man. The milk of cows suffering from febrile conditions, especially when associated with sepsis, should also be excluded. In the case of small single wounds which cease to suppurate, the milk may be used without danger, providing the teats and udder are well cleaned before each milking.

ABNORMAL APPEARANCE AND CONDITIONS OF MILK.

The udder acts as a natural emunctory, like the kidney, and in consequence of its natural selective powers certain active principles contained in various foods, drugs, and poisons are eliminated thereby.

SLIMY, STRINGY, OR ROPY MILK.

These conditions of the milk are not an uncommon occurrence and sometimes are produced by a diseased condition of the udder of the cow, although in the majority

of cases these abnormal appearances of milk are caused by various kinds of bacteria infecting the milk after it has left the udder. While this altered milk may be perfectly wholesome, it is nevertheless unpalatable, and most consumers in this country would rather do without than drink such material.

BITTER MILK.

This condition in the milk is only secondary in importance to the slimy milk and causes much trouble to the dairyman. Bitter milk may originate from two different sources. The first source is dependent upon the cow, while the second is due to the growth of bacteria in the milk after it has been drawn from the animal. The difference between these two classes of bitter milk is that the first has a decidedly bitter taste when freshly drawn, while the second class is sweet when taken from the cow, but the bitterness occurs after standing for a short time and increases in intensity. Only the former will be dealt with at this time. Bitter milk, when produced in the cow, may result from improper feeding with such herbs as lupines, wormwood, etc., or with raw Swedish turnips, cabbages, etc. Bitter milk may also be observed during the late stage of lactation and has followed the infection of teat ducts with bacteria which act on the proteids as an enzyme, converting them into peptones and other products to which the bitter taste is probably due.

COLORING MILK.

Red milk may be produced by the effects of bacteria, but is usually the result of a mixture of blood with the milk, due to an abrasion of the udder or teats, or to some other traumatism of the udder. It may also be due to the cow eating material containing a large amount of silica, as sedges, rushes, etc., or to plants containing red pigment, as madder root. Other plants which are said to impart color to milk are alkanet, field horsetail, meadow saffron, and knot grass. *Bacillus cyanogenus*, the cause of blue milk, at times gets into the udder through the milk ducts and leads to a bluish discoloration of the secretion.

TASTE AND ODOR.

The flavor of milk is very readily affected by the character of the feed, as, for instance, by turnips, garlic, wild onions, moldy hay and grain, damaged ensilage, and distillery grain. The latter is said to cause hyperacidity of the urine and consequent eczema. With proper precautions, however, these substances can be fed to dairy cattle without producing ill effects in the milk. The deleterious substances excreted with the milk are usually volatile oils contained in the food. They are found in the milk as well as in the body, generally in the largest quantity during the digestion of the food containing them, being eliminated rapidly through the various excretory channels. Thus, if these substances are fed eight or ten hours before milking, or if cattle in the spring are removed from the pastures containing garlic this length of time before milking, there will be little or no danger of contaminating the milk. Overkept, fermented, and soured foods tend to produce acidity and other changes in the milk. Swill, spoiled gluten meal, and ensilage put up too green are all more or less injurious to milk. Distillery swill, in addition to the bad flavor which it gives the milk, may cause the secretion of small quantities of alcohol in the fluid. That such alcoholic milk is deleterious to children, as well as to the calves and lambs fed on it, is a well-known and accepted fact. Milk is also modified very sensibly by the use of certain medicines, and the list of drugs which are excreted in the milk and give it an abnormal odor or flavor or render it deleterious to the consumer is quite lengthy. Among the more important may be mentioned opium, all volatile oils, purgative salts, rhubarb, arsenic, mercury, lead, zinc, iron, creolin, scammony, iodine, potassium iodide, antimony, bismuth, ammonia, and certain acids.

POISONOUS MILK.

Toxic properties may be manifested in the milk of cows that have eaten certain poisonous plants. Thus, poison ivy (*Rhus toxicodendron*) produces trembles in cattle, during which condition the milk is capable of producing in the consumer severe gastro-intestinal symptoms with weakness. Leaves of the common artichoke are also said to produce certain toxic properties in the milk which result in abdominal pains and diarrhea in the person consuming it.

COLOSTRUM.

Milk should not be used within fifteen days of parturition or during the first five days after parturition. All cows should be dried off at least fifteen days before calving, not only for the sake of the animal, but also on account of the poor quality of such milk at that time. This milk before and after parturition is called colostrum, and is a yellow, viscid fluid of a strong odor, bitter taste, and acid reaction. The ingestion of such milk is liable to produce diarrhea, colic, and other digestive disturbances.

RECOMMENDATIONS.

In view of the facts above enumerated the following recommendations are made:

1. That all cows on dairy farms producing milk for the District of Columbia be tagged, tattooed, or otherwise marked for purposes of identification.
2. That all milk produced on such dairy farms shall come from either tuberculin-tested cattle, which shall be retested at least once a year, or be subjected to pasteurization under the supervision of the health department in case the herd is not tuberculin tested.
3. That no additions to any herd, whether the herd has been tested or not, shall be made in the future without subjecting the additional cattle to the tuberculin test.
4. That no license shall in future be granted except to applicants having herds free of tuberculosis.
5. That the milk of cattle showing any of the udder affections above mentioned, or anthrax, rabies, gastro-enteritis, septic conditions, or clinical symptoms of tuberculosis, shall not be utilized as human food, even though the milk be pasteurized. Milk from cows fifteen days before and five days after parturition and that from animals receiving any of the deleterious medicaments or foodstuffs previously mentioned shall likewise be excluded.
6. That the veterinary inspectors of the health department make frequent visits to dairies having untested herds, in order that they may discover all advanced cases of tuberculosis, or udder tuberculosis, as early as possible.

MILK SEDIMENTS OR DIRTY MILK IN RELATION TO DISEASE.

By GEORGE M. KOBER, M. D.,

Professor of Hygiene, School of Medicine, Georgetown University.

THE NATURE AND DANGER OF SEDIMENTS.

Every consumer of milk has doubtless observed the presence of more or less foreign matter at the bottom of the bottle in which it is kept; indeed, this is a matter of such common occurrence that it hardly excites our attention, and many are disposed to look upon it as a matter of course. Professor Soxhlet, of Munich, was perhaps the first to point out that these deposits are largely made up of the excrementitious matter from the cow, which, adhering to the udder of the animal, gained access to the bucket during the act of milking. These facts were demonstrated by Professor

Renk at the International Medical Congress held at Berlin in 1890. If these sediments are subjected to microscopical examination we will find that they are composed of epithelial debris, hairs of the cow, organic and inorganic dust particles, excrementitious matter, vegetable fibers, and bacteria, fungi, and spores of every description, fully 90 per cent of the germs being fecal bacilli—all of which is not only disgusting, but extremely suggestive of danger. The number of micro-organisms is largely increased, and we know that under a suitable temperature bacterial development and consequent decomposition are materially hastened in such a medium.

The greatest danger from milk of this class is the possible presence of ptomains or toxins produced by certain saprophytic germs from the albuminoids of the milk. Professor Vaughan, of Ann Arbor, Mich., in 1885 isolated a poison called tyrotoxin which is one of the causes of the toxic symptoms in cases of milk poisoning, cheese and ice-cream poisoning. The presence of the very filth referred to, a summer temperature, and the pernicious habit of placing the milk before cooling in cans and bottles perhaps dirty, besides constitute favorable environments for the development of this and analogous poisons.

Doctor Kober in 1895 collected a number of cases of poisoning by milk, cheese, ice cream, and cream puffs, the symptoms in these cases being nausea, vomiting, dryness, and a sense of constriction of the throat, vertigo, colic, and purging, with a tendency in some cases to collapse, in others to numbness of the extremities and to stupor.

The views of Vaughan, Booker, Escherich, Harrington, Kober, and others on the relation of saprophytic germs and toxins to cholera infantum and the summer diarrheas in bottle-fed children are gaining ground and will doubtless lead to great reform in the management of dairies.

IMPURE MILK A CAUSE OF INFANTILE MORTALITY.

The following facts present strong presumptive evidence on the relation of impure milk to infantile mortality.

1. About one-fourth of all the children born in the District of Columbia and about one-sixth in the country at large perish before the completion of the first year. Of the twelve months during the first year of life the first, second, third, fourth, and twelfth months furnish the highest mortality. The deaths during the first four months are largely due to imperfect development and exposure, while the jump from the fourth to the twelfth month is quite suggestive, as it is the usual period of weaning, with its attending dangers from digestive diseases incident to artificial feeding.

2. Nearly one-half of all the deaths in children under one year of age are caused by gastro-enteric diseases, chiefly infantile diarrhea, and this points with more than mere suspicion to the fact that the morbid agent is introduced into the body with the food. Since the enactment of a pure-milk law in 1895, the per cent of deaths in children under 1 year of age to the total deaths of all ages has been reduced from 26.94 to 18.13 in 1904.

3. The most frightful mortality rates are everywhere furnished by the hand or bottle fed children, indicating that impure cow's milk and improper care and feeding are the chief primary causes.

Professor Kehrer informs us that of the 8,329 infants that died in Munich during 1868-1870, 7,098, or over 85 per cent, had been hand or bottle fed. Of the 4,075 infants that died in 1903, 83.3 per cent were artificially fed. In Berlin, of the 41,383 infants that perished during 1900-1904, over 90 per cent had been artificially fed. In Paris, according to Monat, the rate is from 70 to 75 per cent. In 1903 the health department of the District of Columbia investigated 260 infantile deaths with refer-

ence to feeding and ascertained that 88.49 per cent of the children had been artificially fed.

In the face of the startling arguments against artificial feeding, mothers should hesitate to subject their offspring to such terrible risks, and the state must take what precautions it can to stop this slaughter of the innocents. The Washington market milk compares very favorably with the average German or English milk; but every community has a right to expect milk free from dirt and filth, and hence the need of a law or regulation "that there shall be no visible sediment on standing two hours."

It may be urged that all such modern innovations involve unnecessary hardship, but it should be remembered that by attacking all the various factors concerned in the causation of the disease we may hope for the best results. The reduction in the general mortality in the registration area of the United States from 19.6 in 1890 to 16.2 per 1,000 shows what may be accomplished by preventive medicine and sanitation.

MILK AS A CARRIER OF INFECTIOUS DISEASES.

Milk may acquire infective properties after it leaves the udder of the animal. Numerous instances have been observed in which outbreaks of typhoid fever, scarlet fever, and diphtheria, by their sudden and explosive character, affecting families living in streets and localities supplied by the same milkman, naturally pointed to the milk supply as a common cause. Dr. Michael Taylor, however, was the first physician (in 1857) to point out definitely that cows' milk might serve as a medium of spreading typhoid fever from a dairy where the disease prevailed. In 1867 he also showed that scarlet fever might be distributed in the same way. In 1877 Jacob traced a diphtheria epidemic at Sutton, England, to the milk supply, and in 1872 Macnamara traced an outbreak of cholera at Calcutta, India, to an infected dairy. These facts could not fail to sharpen the powers of observation in others, and in consequence similar outbreaks were more frequently reported, so that Doctor Kober was enabled to present to the International Medical Congress, held in Paris in 1900, the history of 195 outbreaks of typhoid fever, 99 of scarlet fever, and 36 of diphtheria, all traceable to the milk supply.

It has been demonstrated that disease germs may not only survive, but in many instances actually proliferate in the milk, and it is not a difficult matter to point out the many ways by which these germs gain access, especially when some of the employees are also engaged in nursing the sick, or are suffering themselves from some mild infection while continuing their duties, or are convalescent from disease, and thus infect the milk in handling it.

It is quite conceivable how animals, in wading in filth and sewage-polluted water, may infect the udder, and through it the milk, with the germs of typhoid fever. We can also appreciate how infected water may convey the germs when used for washing the utensils or in deliberate adulterations. Infection may also take place through the agency of scrubbing brushes, dishcloths, flies, and exposure to infected air.

MILK-BORNE TYPHOID FEVER EPIDEMICS.

Of the 195 epidemics of typhoid fever tabulated by Doctor Kober, there is evidence in 148 of the disease having prevailed at the farm or dairy. In 67 instances the infection probably reached the milk by percolation of the germs into the well water with which the utensils were washed; in 16 of these the intentional dilution with water is a matter of evidence. In 3 instances the *Bacillus coli communis* and the typhoid germs were demonstrated in the suspected water. In 7 instances infection is attributed to the cows wading in sewage-polluted water and pastures; in 24 instances the dairy employees also acted as nurses; in 10 instances the patients while suffering from a mild attack, or during the onset of the disease, continued their work; and those who are familiar with the personal habits of the average dairy

hands will have no difficulty in surmising the manner of direct digital infection. In one instance the milk tins were washed with the same dishcloth used among the fever patients. In two instances dairy employees were connected with the night-soil service, and in another instance the milk had been kept in a closet in the sick room.

In the recent exhaustive investigation conducted by the Public Health and Marine-Hospital Service the commission definitely traced 85 of the 866 cases of typhoid fever in the District to the use of infected milk.

MILK-BORNE SCARLET FEVER EPIDEMICS.

Of the 99 epidemics of scarlet fever the disease prevailed in 68 instances at the dairy or milk farm. In 6 instances persons connected with the dairy either lodged in or had visited infected houses. In two instances the infection was conveyed by means of infected bottles or milk cans left in scarlet-fever houses. In 17 instances the infection was conveyed by persons connected with the milk business while suffering or recovering from the disease, and in at least 10 instances by persons who acted as nurses while handling the milk. In 3 instances the milk had been stored in or close to the sick room. In 1 instance the cans had been wiped with an infected cloth. (In 19 instances the infection was attributed to disease of the milk cows, such as puerperal fever and inflammation of the udder and teats; but these outbreaks were probably not genuine scarlet fever, but a so-called streptococcus or staphylococcus infection, the symptoms of which closely resemble those of scarlet fever.)

MILK-BORNE DIPHTHERIA EPIDEMICS.

Of the 36 outbreaks of diphtheria, there is evidence that the disease prevailed at the dairy or farm in 13 instances. In 3 instances the employees continued to handle the milk while suffering themselves from the disease. In 12 instances the disease is attributed directly to the cows having inflammatory conditions of the teats and udders. (These instances, however, may be regarded as typical examples of streptococcus and staphylococcus infection, giving rise to a form of follicular tonsillitis or pseudo-diphtheria, often difficult to distinguish clinically from true diphtheria or scarlet fever.)

In addition to the foregoing diseases there are recorded a limited number of outbreaks of cholera which have been traced to milk infection through various channels already referred to, chiefly in handling with infected fingers, by contaminated water, and the agency of flies. There is also reason to assume that the organism of cholera infantum and the infectious agent of smallpox may find in milk a suitable medium for growth and transmission.

It is interesting to note that of the 330 epidemics analyzed by Doctor Kober 243 have been recorded by English authors, 52 by American, 14 by German, 11 by Scandinavian, and 5 each by French and Australian writers. This is probably due to the fact that the English and Americans usually consume raw milk, while on the Continent the milk is rarely used without being boiled.

After the recital of numerous epidemics and milk-borne diseases we need hardly insist upon the necessity of compulsory notification of all infectious diseases, and that milk should not be permitted to leave a farm, dairy, or milk shop during the existence of any of these diseases among the inmates or employees, nor should the latter be permitted to reside in or visit infected houses while engaged in the milk traffic without permission from the health department. The farmer or retailer should in fact be prepared by previous instructions to guard the milk supply from these sources of danger, and should call upon the authorities for an immediate inspection. To prevent great loss incident to these restrictions they may be modified so as to use the milk after proper sterilization under the direction of the health

department. There is nothing strained in the requirements of the proposed legislation, and by its enforcement we may hope to obtain such a standard of milk as will not only effect a decided reduction in infantile mortality, but will render the dissemination of infectious diseases through the milk supply a matter of history only. Until this is accomplished we should patronize only such dealers as sell "certified milk" or subject the milk to pasteurization, or we should simply bring the milk to the boiling point in the household, and, after cooling, keep it on ice; this will not make bad milk good, but it will at least destroy its infectiousness.

SANITARY INSPECTION OF DAIRIES AND DISTRIBUTING DEPOTS.

By ED. H. WEBSTER, M. S.,

Chief of the Dairy Division, Bureau of Animal Industry.

BAD CONDITIONS FOUND ON INVESTIGATION.

A systematic sanitary inspection of dairy farms and milk-distributing depots can not be too strongly recommended. Recent investigations in various parts of the country have conclusively shown that the conditions on many of the farms and at many milk depots are anything but ideal; they are, in fact, about as bad as it is possible to conceive. Stables are poorly lighted, many having no windows whatever, and ventilation is not provided for. Little attention is paid to floors, ceilings, walls, or stable yards. Swine, horses, and poultry are often found in the same barn with the cows. Manure is not removed, or, when removed, is thrown through an opening in the wall or just outside the door, frequently near the milk room. The necessary appliances for sterilizing and cooling in the milk room are often lacking, making it impossible to properly wash and sterilize pails, cans, bottles, and other appliances, or to properly cool and hold at a low temperature the milk before delivery.

Milk dealers as a rule have more regard for sanitation and have better appliances than are to be found on the average farm, but some common practices are deplorable. Very few dealers have appliances for sterilizing bottles. Drivers not infrequently bottle milk on the wagon, using bottles that have come from some household and have not been sterilized. Wagons and appliances are not kept in as sanitary condition as should be required. A number of dealers do not separate business from home operations. Help of unknown origin and doubtful habits is employed and is a constant menace to purity of milk. Up to April 5 of the present year a careful examination had been made, under the supervision of the Department of Agriculture, of 727 dairies supplying milk to the District of Columbia. This examination took into account only the sanitary condition of the farms and did not include the health of the animals nor an examination of the water supply, except as these points would be revealed by observation on the premises at the time of inspection. The average rating of these 727 dairies, on the basis of 100 as perfect, was 55.1 per cent. Thirty-three were above 75 per cent, 278 between 50 and 75 per cent, and 407 scored less than 50 per cent. The tuberculin test had been applied to but 4 of the herds, though many proprietors stated that the test would be applied in the near future. With tested herds and a pure water supply assured, this showing would be deplorable, but under existing conditions of probable water contaminations and but 4 out of 727 herds tuberculin tested, what shall be said?

A similar study has been made of conditions in the city, and the situation there is not nearly so bad as in the country. Seventy-three milk depots were examined, of which 46 were rated above 75 per cent and 27 between 57.5 and 75 per cent.

RECOMMENDATIONS.^a

The situation in Washington is not different from that confronting the health departments of most of the cities of any size throughout the country. The public is gradually awakening to the fact that these conditions must be changed. In order to bring about these changes within the District of Columbia the following recommendations are made:

1. That a sufficient number of inspectors be employed so that each inspector shall have not over 100 farm dairies, and at least three inspectors shall be employed to cover milk stores. That one of these inspectors shall be at the same time chief dairy inspector and shall receive a salary of \$2,000 per annum and traveling expenses.
2. That the inspectors so employed shall devote their entire time to the work of inspection, and that the salaries be commensurate for the technical skill and experience of the men employed—not less than \$1,600 to \$1,800 per year and traveling expenses.
3. That these men shall have technical training in the production and handling of milk, and that at least 5 of every 10 inspectors employed to inspect farms shall be skilled veterinarians.
4. That the health officer shall have full authority to make rules and regulations and enforce the same, so as to safeguard the milk supply of the District from contamination through carelessness, ignorance, or malicious intent.
5. That the health officer or any authorized inspector shall have authority to revoke instantly the license or right to sell milk in the city if provisions of such regulations are not complied with, where, in his judgment, such violation endangers the health of the consumer.

TWENTY-ONE SUGGESTIONS.

The following are suggested as ideal conditions, which might be used as a basis for rules and regulations:

THE COWS.

1. Have the herd examined frequently by a skilled veterinarian. Promptly remove any animals suspected of being in bad health. Never add an animal to the herd until certain it is free from disease, especially tuberculosis.
2. Never allow a cow to be excited by hard driving, abuse, loud talking, or unnecessary disturbances; do not unduly expose her to cold or storms.
3. Clean the entire body of the cow daily. Hair in the region of the udder should be kept short. Wipe the udder and surrounding parts with a clean, damp cloth before milking.
4. Do not allow any strong-flavored feed, such as garlic, cabbage, or turnips, to be eaten except immediately after milking.
5. Salt should always be accessible.
6. Radical changes in feed should be made gradually.
7. Have fresh, pure water in abundance, easy of access, and not too cold.

THE STABLES.

8. Dairy cattle should be kept in a stable where no other animals are housed, preferably without cellar or storage loft. Stable should be light (4 square feet of glass per cow) and dry, with at least 500 cubic feet of air to each animal. It should have air inlets and outlets, so arranged as to give good ventilation without drafts of air on cows. The presence of flies may be reduced by darkening the stable and removing the manure as directed below.
9. The floor, walls, and ceilings of the stable should be tight, walls and ceilings

^a These recommendations were referred to the committee on the control of the milk supply from an administrative standpoint (see report, page 37).

being kept free of cobwebs and whitewashed twice a year. There should be as few dust-catching ledges and projections as possible.

10. Allow no musty or dirty litter or strong-smelling material in the stable. Store manure under cover at least 40 feet from the stable in a dark place. Use land plaster daily in gutter and on floor.

MILK HOUSE.

11. Cans should not remain in the stable while being filled. Remove the milk of each cow at once from the stable to a clean room; strain immediately through cotton flannel or absorbent cotton; cool to 50° F. as soon as strained; store at 50° F. or lower. All milk houses should be screened.

12. Milk utensils should be made of metal, with all joints smoothly soldered, or, when possible, should be made of stamped metal. Never allow utensils to become rusty or rough inside. Use milk utensils for nothing but handling, storing, or delivering milk.

13. To clean dairy utensils use pure water only. First rinse the utensils in warm water; then wash inside and out in hot water in which a cleansing material has been dissolved; rinse again; sterilize with boiling water or steam; then keep inverted in pure air that may have ready access, and sun if possible, until ready for use.

MILKING AND HANDLING MILK.

14. The milker should wash his hands immediately before milking and should milk with dry hands. He should wear a clean outer garment, which should be kept in a clean place when not in use. Tobacco should not be used while milking.

15. In milking be quiet, quick, clean, and thorough. Commence milking at the same hour every morning and evening, and milk the cows in the same order.

16. If any part of the milk is bloody, stringy, or unnatural in appearance, or if by accident dirt gets into the milk pail, the whole mess should be rejected.

17. Weigh and record the milk given by each cow.

18. Never mix warm milk with that which has been cooled, and do not allow milk to freeze.

19. Feed no dry, dusty feed just previous to milking.

20. Persons suffering from any disease, or who have been exposed to a contagious disease, must remain away from the cows and the milk.

21. It is needless to say that the shorter the time between the production of milk and its delivery, and between delivery and use, the better will be the quality of the milk.

THE WATER SUPPLY OF DAIRY FARMS.

By G. LLOYD MAGRUDER, M. D.,

Emeritus Professor of Materia Medica and Therapeutics, School of Medicine, Georgetown University.

DANGER FROM A POLLUTED WATER SUPPLY.

The influence of a polluted water supply has long been recognized as a most potent cause of disease. Many virulent epidemics have been directly traced to this origin. The literature upon this subject is so full of instances that it is needless to cite examples. Immediate closure of such water supplies in cities, when sewage bacteria have been detected, has been universally recommended. The recent report to the Commissioners of the District of Columbia by the United States Bureau of Public Health and Marine-Hospital Service lays special stress upon this point.

How much more is this danger augmented when such bacteria are found in the

water supply of the dairy farms! It is well known that few farms have the proper facilities for boiling the water that is used for washing the hands of the employees, the dairy utensils, and the udders of the cows. Polluted water readily contaminates the milk, which contamination is rapidly increased by the multiplication of the bacteria when the temperature is above 50° F.

It is a well-known fact that persons who have once had typhoid fever may continue for an indefinite period to be carriers of the bacillus. The recent investigations of Doctor Soper, of New York, who isolated the bacillus of typhoid from the feces of a cook who refused to give her history as to having had the disease, showed seven outbreaks of typhoid fever, giving 26 cases, with one death, in families in which this cook had been employed. The common custom which prevails in rural communities of depositing human excreta upon the surface of the ground, frequently in close proximity to residences and barns, has been repeatedly noticed. Even in cases of disease this has been done without previously disinfecting the discharges.

Bulletin 93 of the Bureau of Animal Industry, United States Department of Agriculture, recently issued, reports the isolation of the tubercle bacillus from the feces of cows and the production of tuberculosis by inoculating guinea pigs with the bacillus thus isolated. In healthy cows, tuberculin tested, these same results were obtained after giving them water to drink in which tubercle bacilli had been placed.

In view of the possible presence of the bacilli of typhoid fever and tuberculosis, the question of sewage bacteria in the water supplies of the dairy farms is a much more serious matter than was formerly considered. The knowledge that typhoid fever was two and one-half times more prevalent in 1906 in the counties of Maryland than in the city of Baltimore, and the evidence, as stated elsewhere in this report, that 148 out of 195 epidemics of typhoid fever attributed to milk were directly traced to the dairy farm, add to the seriousness of these conditions.

It has been observed that many wells, springs, and cisterns are loosely or not at all covered, poorly protected from surface drainage, and, in numerous cases, are located in close proximity to the barnyard or the household privy, at times even in places that catch the drainage from the same.

EXAMINATIONS OF WATER SUPPLIES OF DAIRY FARMS.

The examinations made by officials of the Department of Agriculture during November and December, 1906, in comparatively cool weather, showed that of the 60 water supplies of dairy farms taken at random in Maryland, Virginia, and the District of Columbia 16 contained less than 500 bacteria per cubic centimeter and were free from *Bacillus coli*; 6 below this number contained the colon bacillus. The remaining 44 water supplies contained bacteria up to 27,200. Of these 44, 21 contained the colon bacillus.

These tests warranted the classification of these water supplies as follows: Sixteen good, 15 fair, 17 suspicious, and 12 unfit for use. From Professor Sedgwick's classification, 44 would have been considered polluted. In a recent letter he says: "I should say that all of the wells under consideration which had more than 100 bacteria per cubic centimeter were to be classed as suspicious, and that those having 500 or over were in all probability polluted."

The results of these examinations confirm the wisdom of the recommendation made in 1894 by the committee of the Medical Society of the District of Columbia upon the prevalence of typhoid fever, for the careful inspection of all dairy farms for all possible sources of infection, including the water supply, and prove that repeated chemical and bacterial tests should be made of the water supply of every dairy farm supplying milk to the city of Washington. They afford another proof of the imperative need of a well-equipped chemical and bacteriological laboratory for the health officer.

HOW TO REMEDY INSANITARY CONDITIONS.

Fortunately many of these insanitary conditions upon the farm can be readily and easily remedied by the farmer himself by the exercise of a little care and at a very trifling cost.

All water, except that above suspicion, used for dairy purposes should be boiled. Those engaged in the handling of dairy products should be required to observe the greatest care as to the cleanliness of their clothes and persons. Frequent washing of the hands should be practiced. The source of the water supply should be at least 50 feet from any possible infection, and a greater distance if in line of drainage from any infection.

The wells, springs, and cisterns should be carefully walled and covered to protect them from seepage, drippings, and dust. A well-built coping, extending a foot or more above the ground, would be very effectual. Preferably deep-driven wells should be used when possible. Owing to the inclination of the rock formation in the vicinity of Washington, D. C., these are not always absolutely reliable. When a well is found to be polluted it should be thoroughly cleaned and properly disinfected.

All fecal discharges should be deposited in a safe place, and those from fever cases in addition should be intelligently disinfected.

Since freezing does not immediately kill bacteria, careful supervision should also be observed over the supply of water and the location of ice ponds from which ice is obtained for household and dairy purposes.

By observing these simple precautions, which would in no way be a hardship to the producers, much would be accomplished toward securing a better milk supply.

EXAMINATIONS OF POTOMAC WATER, SHOWING ADVANTAGE OF FILTRATION.

The series of check experiments conducted during September, October, and November, 1906, by the Department of Agriculture and those in charge of the filtration plant demonstrated its efficiency as a safeguard against typhoid infection from the Potomac River. The following report of the examinations of the Potomac water supply at Washington, D. C., for March, 1907, confirms the deduction heretofore made:

Report of examinations for colon bacilli of water supply at Washington Aqueduct, D. C., filtration plant, March, 1907.

	Size of samples.	Total samples examined.	Number of samples positive.	Per cent of samples positive.
	cc.			
Dalecarlia inlet.....	10	8	7	88
	1	8	4	50
	1	8	0	0
	10	8	6	75
Dalecarlia outlet.....	1	8	3	38
	1	8	0	0
	10	8	3	38
Georgetown reservoir.....	1	8	2	25
	1	8	0	0
	10	26	8	31
Washington City reservoir outlet.....	1	26	2	8
	1	26	0	0
	100	26	0	0
Filtered water reservoir.....	10	26	0	0
	1	26	0	0
Tap water from various parts of the city.....	10	47	1	2
	1	47	0	0

MILK DURING TRANSPORTATION.

By EMILE BERLINER.

REQUIREMENTS FOR COOLING.

The shipping of the milk from the farm until it reaches the consumer requires no abnormal care if provisions are made for keeping the temperature of the milk at or below the legal standard, usually 50° F.

For the District of Columbia no artificial refrigeration will probably be required from December 1 to May 1, and when once special cooling devices have been everywhere introduced these can be relied upon to help out almost automatically should warm-weather spells occur in March, April, or December.

By March 1 the supply of ice can have been stored on the farm if from natural sources, or the river or spring water is chilly enough to serve for refrigeration to the legal standard. The law might even make some allowance for the unexpected or abnormal heat which is sometimes encountered in this latitude during winter months or in early spring.

From May 1 to December 1, however, it becomes imperative to prevent artificially the rise of temperature in milk and thereby prevent the dreaded multiplying of a small number of bacteria into hundreds of thousands or millions. The remedy consists in providing for refrigerating devices on the farm and at the railroad station and for refrigerator cars on the milk trains.

Farmers who bring their milk into the city by wagon should be required to carry at least crude boxes into which the milk cans or bottles are placed and packed with crushed ice. As for milk hauled to the railroad station, the distances are rarely great enough to warm the milk seriously in transit, provided it has been well chilled at the farm. Milk inspectors may be relied upon to call attention to any serious evading of the spirit of the law.

Milk known as certified must of course be rigidly kept down to standard temperature in all kinds of weather, and no latitude is permissible for this product.

DUTIES OF RAILROADS.

Railroads up to a distance of, say, 60 miles from the city of Washington should be required to run one or more refrigerator cars from May 1 to December 1, and also to provide cooling rooms or devices at all stations where milk is held awaiting the arrival of the milk trains. They should, moreover, be diligent in having the milk unloaded and delivered promptly on arrival in Washington. Railroad companies should have the right to demand that only two trains a day be run for the transportation of milk and cream, and, furthermore, that the cans or bottles of milk shippers arrive at the station not earlier than half an hour from the schedule time of the milk train for that station.

A simple cooling device for railroad stations would consist of a sufficiently large block of ice put on a stand 3 feet high, the milk cans or bottles to be grouped closely around this, and a heavy canvas thrown over the ice block and the cans, the canvas being large enough to trail on the ground. The price chargeable by railroads for refrigeration should be regulated by law or ordinance. Milk producers along a railroad who haul their product to way stations having no agent or station master should themselves provide means to keep the milk cool while waiting for the train.

CREAM FROM LONG DISTANCES.

A serious menace will be found in the shipping of cream from long distances, generally for making ice cream, which practice prevails during summer time. Cream is shipped to Washington from as far away as New York City, and nobody knows how long a time has elapsed since it left the farm where it was originally produced,

which may be hundreds of miles still farther away. There is every reason to suspect that such cream has been treated with formaldehyde or other preservatives, and inspectors should be on a special lookout for such shipments and carry a thermometer and such quick-test chemicals as amidol or other reagents.

DENATURING OF MILK OR CREAM CONTAINING PRESERVATIVES.

The law should be framed to compel an immediate seizure and denaturing with some odorous substance or coloring matter of cream or milk in transit or otherwise and found by inspectors to contain preservatives for preventing souring or spoiling; and if found above the standard temperature but otherwise pure, it should be pasteurized and sold as milk or cream of the third class.^a

BOTTLING, ETC.

Milk graded as certified should all be shipped in sanitary bottles of glass or other satisfactory material, and never in bulk, which would require its being put into bottles after arrival in the District of Columbia; but any milk, even if certified, if intended to be pasteurized after arrival, may be permitted to be shipped in cans or in bulk.

Bottles containing milk of classes 1 and 2^a should all bear a mark giving the name and location of the farm where it was produced and the class of milk contained.

It is furthermore of great importance that milk graded as certified should, when bottled, be sealed in such a manner that it can not readily be tampered with by unfaithful drivers without such tampering being easily detectable. Dairy supply farms carry in stock certain safety seals for that purpose, and it is recommended that there be introduced, under the direction and control of the health officer, a system of color changing and date markings of paper strips pasted across the milk caps which will make the removing of these seals and the substituting of others a more or less difficult task.

REFILLING OF COLLECTED BOTTLES.

Grave charges have been made of the practice by unfaithful drivers of filling on their wagons, from cans carried along with them, bottles just collected from doorsteps; and in order to prevent such malpractice a law was suggested preventing the carrying on the same delivery wagon of milk both in bulk and in bottles. Milk dealers objected to such a law, saying that some milk might be sold wholesale on the route of their retail delivery wagons, and it would entail extra expense to send out separate wagons for both classes of customers over the same routes. A remedy might be found in requiring that such double delivery should be made only from wagons which are divided into two compartments, one for milk in bulk, to be accessible only from the rear of the wagon by the driver getting down from his seat, and a second or front compartment to contain only milk in bottles. In this manner drivers resorting to the filling of bottles could be more readily detected. Moreover, it would not cost much to build a partition in any existing milk wagon, thereby making it serviceable under such a regulation.

It has also often been charged that drivers have been seen filling pint bottles just collected from doorsteps out of full or partly full quart bottles carried on the wagon. It is difficult to determine to what extent this serious practice prevails, and it is still more difficult to devise a remedy for it. It is entirely possible that some irresponsible milk dealer may have ordered his driver to freely fill such pint bottles on every route, as it would greatly simplify his work, by taking pint bottles just collected, giving them even a sort of rinsing, and filling them on the wagon, instead of carrying them back empty.

^a See classification on pages 6 and 7.

One remedy which suggests itself as simple enough to be practicable would consist in prohibiting by law the collecting of empty pint bottles on delivering routes. Violations of this law would be easy of detection both by milk inspectors and by householders buying pint bottles of milk.

Another remedy would consist in milk dealers seeing their way to deliver pints of milk in paraffined paper bottles, thereby doing away with collecting them when empty, and thus insuring their customers against malpractices of unscrupulous drivers. Such paper bottles are now being introduced, but whether they are as sanitary as glass bottles would of course have to be decided by competent authority.

A third method is the sealing of bottles by pouring over their caps a small quantity of melted paraffin, ozokeride, or other cheap and innocuous wax; and this plan might also be adopted for certified milk bottles instead of the paper strips heretofore mentioned.

Exceptions regarding the filling of bottles or receptacles from a wagon are of course permissible, if, as provided in section 11 of House bill 21670, such receptacles are furnished for that purpose by the housekeeper. The law having been complied with on this point, it becomes the duty of the housekeeper to see that the milk is kept cool and otherwise to take intelligent care of it. It would be within the province of the health officer to issue bulletins to the public from time to time, instructing housekeepers in the best methods of handling and keeping milk after it has been delivered.

COMMERCIAL CLASSES OF MILK.

By A. D. MELVIN, D. V. S.,
Chief of the Bureau of Animal Industry.

In view of the elaborate manner in which the necessity for a pure milk supply has been pointed out, and of the many obstacles in the way of obtaining such a supply except through vigorous official supervision, it is believed that if the milk supply is divided into three classes as hereinafter described, and an efficient supervision provided, the consumer will be amply protected in securing clean and uncontaminated milk. The following recommendations are therefore respectfully submitted:

That the milk supply of the city be divided into three classes, to be known as classes 1, 2, and 3.

The specifications for certified milk for infants to be the same as recommended by the milk conference, and to be known as class 1.^a

Class 2 to be clean, raw milk from healthy cows, as determined by the tuberculin test and veterinary physical examination; the cows to be housed, fed, and milked under good conditions, but not necessarily equal to the conditions provided for class 1; pure water, as determined by chemical and bacteriological examination, to be provided; the bacteriological count of the milk not to exceed 100,000 bacteria per cubic centimeter at the time the milk reaches the city, at any season of the year, as determined by the health department at frequent intervals; milk to be delivered to the customer in sterilized containers, and the temperature of the milk not to exceed 50° F. until delivered to the consumer.

Class 3 to be milk from all other dairies not able to comply with the requirements for classes 1 and 2, this milk to be clarified and pasteurized at central pasteurizing plants, which shall be under the personal supervision of an officer of the health department. These pasteurizing plants may be provided either by private enter-

^aSee page 6.

prise or by the District government, and should be located within the city of Washington. Class 3 milk should not be permitted to exceed 60° F. in delivery from the dairy to the pasteurizing plants. The milk from these pasteurizing plants, placed in sterilized containers, should be delivered to the consumer at a temperature not exceeding 50° F. All milk of unknown origin should be placed under class 3 and subjected to clarification and pasteurization. It should also be provided that no cows suffering from any communicable disease or any unfit condition, to be determined upon physical examination by an authorized veterinarian, shall be permitted in any dairies; and, further, that cows which do not show any physical signs of tuberculosis upon veterinary examination, but which may have reacted to the tuberculin test, may be included in dairies supplying milk of this class.

No dairy farm should be permitted to supply milk of a higher class than that for which the permit has been issued and each dairy farm supplying milk of a specified class should be separate and distinct from any dairy farm of a different class; the same owner, however, might supply different classes of milk, providing the dairy farms are separate and distinct, as above indicated.

All milk to be of good composition, free from adulterants and artificial coloring matter.

The term "milk" to include both milk and cream.

PASTEURIZATION.

By M. J. ROSENAU, M. D.,

Director of the Hygienic Laboratory, United States Bureau of Public Health and Marine-Hospital Service.

The following is only a summary of investigations that will be reported in detail at a later time.

ADVANTAGES.

The advantage of pasteurization is that it is a cheap and effective means of preventing the transmission of infectious diseases, such as tuberculosis, typhoid fever, diphtheria, scarlet fever, etc., commonly spread by milk. It also probably has a favorable influence in preventing or ameliorating the severity of some of the intestinal disorders of children caused by impure milk.

DISADVANTAGES.

Some of the objections urged against pasteurization are considered below:

1. Pasteurization promotes carelessness on the farm and dairy, etc.

This may be controlled by proper regulations, inspections, and laboratory examinations.

2. Pasteurization renders milk less digestible.

While it is generally conceded that boiled milk commonly induces constipation, the majority of the evidence plainly indicates that pasteurization has little, if any, effect upon the digestibility of the milk.

3. Pasteurized milk favors the production of scurvy.

Authorities agree that the danger, if any, is slight, and, further, that it may readily be obviated.

4. By destroying the nonspore-bearing bacteria pasteurization sometimes allows toxic organisms to grow and produce serious poisons in the milk.

On the other hand, these same poisons are more frequently produced in milk that has not been pasteurized, and this danger may be obviated in pasteurized milk by cooling it quickly, keeping it cold, and shortening the time for distribution.

5. Pasteurization is inefficient as a preservative.

This is really no disadvantage, for the quicker bad milk sours the better.

6. Pasteurization injures the taste of the milk.

This is not so, if properly done.

7. Pasteurization increases the cost of the milk.

True; but it is the cheapest safeguard, and the expense of pasteurization is offset by the keeping quality of the milk.

METHODS.

The milk must be heated to a temperature of 65° C. for twenty minutes, or 70° C. for ten minutes as soon as practicable after the milking, in inclosed vessels, preferably the final containers. After pasteurization the milk must be promptly cooled, kept cold, and distributed with promptness.

The advantages so far outweigh the disadvantages that I unhesitatingly recommend compulsory pasteurization of all milk not certified under class 1 and class 2 of Doctor Melvin's classification.

The foregoing papers were adopted and submitted, under date of May 1, 1907, as a report of the committee to consider the sanitary aspects of the milk supply. The personnel of this committee was as follows: Dr. George M. Kober (chairman), Mr. Emile Berliner, Dr. G. Lloyd Magruder, Dr. Charles F. Mason, Dr. A. D. Melvin, Dr. John R. Mohler (secretary), Col. Robert G. Smith, and Mr. Ed. H. Webster.

On May 15, 1907, this committee submitted to the conference a second report, as follows:

REPORT OF THE COMMITTEE TO CONSIDER THE SANITARY ASPECTS OF THE MILK SUPPLY.

OPPOSITION OF THE MILK INDUSTRY TO REASONABLE REQUIREMENTS.

It is a remarkable fact that every attempt to improve the purity of this invaluable article of food should be promptly opposed by the milk industry, which constitutes a strong spoke in the commercial wheel and evidently considers it meddlesome interference with the trade. The men engaged in this industry evidently do not know, and can not know, that such hydra-headed diseases as cholera infantum, scarlet fever, and diphtheria have been disseminated in the milk supply, that typhoid-fever epidemics have been thus caused, and that milk may be the vehicle of the germs of tuberculosis and other infectious diseases and moribund agents.

Pure, natural milk can only be secured at dairies with sanitary buildings; a pure water supply; healthy, well-fed, and well-cared-for cows; a well-equipped and well-kept milk room; provisions for thorough cleanliness; intelligent and conscientious people in charge, and clean methods throughout. There are a number of persons, thanks to the training received at the dairy schools, who make an honest effort to place on the market milk obtained under such conditions, but by far the majority of milk producers are indifferent to hygienic requirements and would prefer the good old days when there was no control even to prevent the shameful adulterations of milk by the intentional dilution with water, the removal of some of its cream, or the addition of skimmed milk—practices which, alas, still exist.

Dr. H. W. Wiley, Chief of the Bureau of Chemistry, United States Department of

Agriculture, reports that during the last few months his Bureau examined 327 samples of milk bought in Washington, of which 56, or a little over 17 per cent, had been skimmed or watered; and of 96 samples of cream, 38, or 39.95 per cent, were below the standard required by law.

The records of the health department of the District of Columbia show that during the past five years 28,859 samples of milk were examined, and that of these 6,801, or 23.5 per cent, were below the fixed standard, and in 1,305 instances prosecutions for the sale of adulterated milk were presented in the courts.

These robberies, largely made up of the pennies of the poor and sickly women and half-starved children, amount in money value to considerably more each year than the entire cost of the health department.

Matters of this kind should not be left, therefore, to the individual dealers, but the principles which ought to be carried out should be embodied in effective laws and accepted and enforced in a practical sense.

Honorable men will not object to regulations calculated to promote the purity of their product and the health of their customers, and as many of the most serious faults in the milk business are the result of ignorance rather than of intentional neglect, the difficulties will be materially lessened by proper education and trade competition. At all events, the dairyman will conclude in the end that it is money in his pocket to comply with requirements which at present may appear to him the outcome of exaggerated fear or extreme sanitary zeal of theorists.

So, for example, frequent inspections of the dairy stock will be a source of ultimate profit to the owner, as the presence of tuberculosis or any other communicable disease endangers his entire herd, and great losses can be prevented by the prompt isolation or extermination of the first cases. The farmer will likewise find that if he houses his cattle in spacious, well-lighted, and well-ventilated stables, or even in properly constructed sheds, there will be less tuberculosis and sickness among the herds. Indeed, every recommendation so far submitted by the committee is not only in the interest of the public health, but also of benefit to the farmer, and if the production of a clean, wholesome milk involves increased cost, the committee is on record to the effect that the additional expense should be borne by the consumer.

EVIDENCE THAT MILK IS A CAUSE OF DISEASE.

1. It has been shown by the most painstaking investigations, extending over a long period of years, that certain diseases in the animal are communicable through the medium of the milk, this being especially true of tuberculosis, foot-and-mouth disease, anthrax, and cowpox; and that diseases like garget, gastro-enteritis, and septic fevers in the cow will render the milk morbid to man.

2. It has been shown that animals which have fed on poisonous forage plants or have been treated with strong medicaments are disqualified from producing a pure or sound milk.

3. During the past twenty-five years there have been published in the different medical journals the histories of 195 epidemics of typhoid fever, 99 of scarlet fever, and 36 of diphtheria, all traceable to the milk supply.

In the recent exhaustive investigation conducted by the highest health authority in this country, viz., the United States Bureau of Public Health and Marine-Hospital Service, the commission definitely traced 85 of the 866 cases of typhoid fever (about 10 per cent) in the District of Columbia to the use of infected milk.

4. It has been shown in a former report that in the District of Columbia about one-fourth, and in the country at large about one-sixth, of all the children born perish before the completion of the first year; that nearly one-half of the deaths in children under 1 year of age are caused by gastro-enteric diseases, chiefly infantile diarrhea, and that of the 54,047 infantile deaths which have been investigated at home

and abroad with reference to feeding, 86.6 per cent had been artificially fed, all of which points with more than mere suspicion to the fact that the morbid agent is introduced into the body with the food (cow's milk).

WASHINGTON MARKET MILK.

The Washington market milk compares favorably with the supply in other cities. There is no evidence to show that it is worse, but there is abundant evidence to indicate that stale and infected market milk is everywhere responsible for a needless sacrifice of human life, and it is clearly the duty of the state to take what precautions it can to prevent sickness and distress. To indicate the value of sanitary control in this city it may be stated that since the enactment of a pure-milk law in 1895 the percentage of deaths in children under 1 year of age to the total deaths of all ages has been reduced from 26.94 to 18.36 in 1905.

TEMPERATURE OF MILK.

The committee on certified milk and the committee on sanitary relations of the milk supply have both emphasized the importance of cooling the milk and keeping it at a temperature below 50° F., except as may be necessary in the process of pasteurization or sterilization, until the milk is delivered to the consumer. The reason for this is that milk when it leaves the udder contains very few germs; the majority gain access during handling, especially when the milking is done in a dusty stable, or from excrementitious matter adhering to the teats and udder of the animal. These germs multiply with astonishing rapidity whenever the temperature of the milk is above 50° F., and if disease germs are present their proliferation augments the chances of infection. A temperature of 58° or 60° F. will not subserve the interests of public health. So, for example, "Petruschky has shown that at a room temperature a streptococcal content of 300 per cubic centimeter may increase in twenty-four hours to one of 10,000,000; but the same milk kept at 50° F. yielded but 30,000, or but three one-thousandths as many." (Harrington.)

Von Freudenreich (Dairy Bacteriology, London, 1895) exposed a sample of milk containing 153,000 bacteria per cubic inch to a temperature of 59° F. One hour after it contained 539,750 bacteria per cubic inch; two hours after, 616,250; four hours after, 680,000; seven hours after, 1,020,000; nine hours after, 2,040,000; twenty-five hours after, 85,000,000. Bryce, of Toronto, has made similar investigations.

The question of germ development and souring of milk is influenced, therefore, largely by the temperature. To reduce the temperature of milk in summer to 50° F. necessitates the use of ice. Some farmers maintain that they have no opportunity for buying or securing ice, and use this as an argument against the provisions of the proposed legislation requiring the cooling of milk. Dr. G. Lloyd Magruder, with commendable zeal and thoroughness, has investigated this question in a perfect spirit of fairness to the producer and shipper, and a letter from Prof. Willis L. Moore, Chief of the United States Weather Bureau, to Doctor Magruder, dated December 29, 1906, shows that for the last thirty years there was but one winter (that of 1889-1890) during which ice could not have been gathered from ponds in the vicinity of Washington.

INCREASED COST SHOULD BE BORNE BY THE CONSUMER.

The use of ice will result in a slight increase in the cost, and your committee is not unmindful of the fact that while everything else may advance in price without serious remonstrance, loud outcries are made whenever a progressive dairyman declares that the production of clean, wholesome milk involves an advance of 1 or 2 cents a quart. In the language of Professor Harrington, "the public needs proper education that clean milk is a necessity, and that infant sickness and funerals can be

reduced at least 40 per cent. * * * A model farm properly manned certainly can not compete on equal terms with a filthy farm, where no attempt is made to conduct the business in a decent manner, especially if customers are indifferent. The dirty producer can even afford to cut prices and take customers away from the other if customers care to save a cent and make it up in pus and cow dung."

CERTIFIED MILK.

It was in consequence of a just appreciation of these principles that the so-called "certified milk" came into existence about ten years ago. Responsible bodies of citizens interested in an improved milk supply organized in different cities milk commissions. Such commissions usually select and secure the advice and assistance of four experts—a veterinarian, a physician, a bacteriologist, and a chemist—all more or less familiar with the conditions and possibilities on dairy farms. The commission sends to each dairyman who supplies milk to the city a circular naming all the particular conditions which should be found on every farm where milk is produced for city use, and announcing that where any dairyman notifies the commission that he is fully conforming to the conditions specified, or endeavoring to do so, his dairy will be inspected, and if it is found to comply in letter and spirit to all the requirements, his name will be placed upon an approved list and he will receive an official indorsement to the effect that his dairy farm and the herd thereon have been thoroughly examined and found to comply with the conditions recommended by the commission. These conditions include a healthy herd, the use of pure feeds, appropriate stabling and care, pure water, and clean and prompt handling of the milk, which is of good composition and quality and so free from pathogenic and unnecessary bacteria as reasonable safeguards can provide. The attendants are cleanly and free from communicable diseases, and all milk is promptly cooled immediately after milking to a temperature of 50° F. Every intelligent dairy farmer insists upon cooling his milk as soon as the bucket is full.

The inspections are made unannounced and at irregular intervals, so as to insure maintenance of the prescribed standard. Any neglected condition is immediately reported to the commission, which decides whether or not the cause is sufficient to withdraw and cancel the last certificate issued.

Certified milk is reasonably safe, but this is no guaranty that it may not occasionally contain germs of disease, and those who desire to guard against this slight risk should pasteurize it in the home.

PASTEURIZED MILK.

It must be apparent that it will require time and education to secure compliance with even reasonable safeguards, and it is equally evident that the number of dairy farms now in a position to live up to sanitary requirements will supply but a small percentage of the population, although it is hoped that such dairy farms will be stimulated into existence by trade competition and the refusal of the public to buy dirty milk at any price. Until this is accomplished, the committee in the interest of public health strongly advocates clarification and pasteurization of all milk. This, to be sure, will not make bad milk good, but it will at least destroy its power to transmit disease germs.

PASTEURIZING PLANTS OR MILK DEPOTS.

Your committee also believes that this object can be most efficiently and economically secured by the establishment of a pasteurizing plant provided by the District government, or preferably by private enterprise, which plant should be under the supervision of the health department.

There is every argument from a commercial and sanitary standpoint in favor of a central plant, erected within reasonable distance from the union depot, where all the

milk for the city should be received and prepared for distribution. Such a step would result in the creation of suitable conditions for the proper handling and storage of milk, sterilization of milk cans and utensils; and the efforts of the local milk dealers to provide decent facilities for their 150 or more dairies scattered over the city, all more or less liable to infection, could be concentrated in one plant with a decided saving of expense.

Milk should never be sold by grocery stores or milk shops unless it has been delivered to such establishments in original sealed bottles, and then only when there is provision for maintaining the milk at a temperature of 50° F.

ADVANTAGES AND DISADVANTAGES OF PASTEURIZED MILK.

Your committee is aware that there is a difference of opinion among medical men as to the wholesomeness of pasteurized milk. The advantages and disadvantages have been exhaustively studied by Dr. M. J. Rosenau, Director of the Hygienic Laboratory of the United States Bureau of Public Health and Marine-Hospital Service, and in his opinion the advantages so far outweigh the disadvantages that he "unhesitatingly recommends compulsory pasteurization of all milk not certified under class 1 or class 2 of Doctor Melvin's classification."

IMMEDIATE REMEDIAL ACTION.

Your committee is so strongly impressed with the manifold dangers connected with the milk supply that until the needful reforms in dairy methods are accomplished it recommends to the public the following as immediate safeguards:

1. Do not patronize a milk dealer at any price whose milk after standing for two hours reveals a visible sediment at the bottom of the bottle. It is evidence of dirty habits, extremely suggestive of danger, and entirely preventable by clean, decent methods without greatly increasing the cost.

2. Subject all your milk to home pasteurization, by simply bringing it to the boiling point, and after cooling keep the milk on ice. This will destroy germ life and reduce the chances of milk-borne diseases to a minimum; and if we can reduce our typhoid-fever rate even only 10 per cent by this simple method, not to mention infantile diarrheas and other infectious diseases, it is clearly our duty to do so.

3. Your committee recommends that the results of the recent investigations into the milk supply conducted by the Bureau of Public Health and Marine-Hospital Service and by the Bureau of Animal Industry and the Bureau of Chemistry of the Department of Agriculture with a view to supplementing the work of the health department, which on account of its limited force and laboratory facilities could not possibly conduct such an exhaustive investigation, be placed at the disposal of the Commissioners of the District.

4. In conclusion your committee recommends that until the health department shall be in control of a bacteriological laboratory and a sufficient number of inspectors the health officer request the continuance of the cooperation of the Bureau of Public Health and Marine-Hospital Service and the Department of Agriculture for improving the local milk supply.

REPORT OF THE COMMITTEE TO CONSIDER THE MILK SUPPLY IN ITS RELATION TO THE FEEDING OF INFANTS.^a

[Submitted to the conference April 17, 1907.]

The committee has considered at some length the steps which should be taken to secure, if possible, a better grade of milk for the use of infants, and the following recommendations have been unanimously adopted:

1. That the milk which is supplied to infants under the age of 3 years in the District of Columbia should be certified by the health officer. Milk should contain not more than 5,000^b bacteria per cubic centimeter, should be not more than twelve hours old, and should be delivered in artificially cooled packages, the term "artificially cooled packages" not to be interpreted to require the constant presence of ice, but merely the keeping of the contents at the prescribed temperature.

2. That the health officer of the District be authorized to advertise for dairies which will be willing to so modify their barns, stables, etc., if necessary, as to secure a license from him for the production of certified milk under the most modern improved sanitary conditions.

3. That each cow furnishing the milk in the dairy be tested, under the supervision of the health officer, for tuberculosis or other contagious or infectious diseases, and that any animal so suffering be excluded from the herd.

4. That a daily sample or samples drawn from the supply of each certified milk furnished to the city be secured for the purpose of making the bacterial count and determining the chemical composition, etc.

5. That parents and guardians be urged to use only certified milk, at least for infants' food, in the District of Columbia for all infants under the age of 3 years.

6. That if private dairies can not be induced to furnish certified milk, the Commissioners of the District of Columbia, as a health measure affecting in the highest degree the welfare of the District of Columbia, be asked, if it can be legally done, to establish a municipal dairy for the purpose of furnishing certified milk for the use of infants under 3 years of age in the District of Columbia.^c

7. That, pending the time which must necessarily elapse for the inauguration of a service of certified milk for infants' use, the health officer be authorized, as a result of his inspections, to publish a list of dairies from which the milk supply is drawn, giving the average rating of each dairy, the chemical composition and bacterial count of the samples.

8. That for the purpose of securing modified milk for infants in ill health, according to the prescription of physicians, the milk commission of the District Medical Society be requested to secure the establishment of a laboratory under its supervision in which only certified milk shall be used, and in which, by the use of a separator or otherwise, milk of a definite chemical composition may be prepared from certified milk, in harmony with the physicians' prescriptions relating thereto.

9. That a complete chemical and bacteriological laboratory be established in connection with the health office of sufficient size to do all necessary work.

10. That the term "certified milk" as used herein is to be applied to milk secured at dairies subject to a periodic inspection, and the products of which are subjected to

^aThe personnel of this committee was as follows: Dr. H. W. Wiley, chairman; Dr. D. Percy Hickling, Dr. J. W. Kerr, Dr. E. R. Stitt, Dr. W. M. Sprigg, Gen. George M. Sternberg, and Dr. William C. Woodward.

^bThe recommendation subsequently adopted by the conference was that certified milk should contain not more than 10,000 bacteria per cubic centimeter.

^cThis recommendation was referred back to the committee for further consideration.

constant analyses. The cows providing the milk must be properly fed, free from tuberculosis or other contagious diseases, and housed in clean stables, properly ventilated, and they must be supplied with wholesome water and feed, and kept clean. The milk must be drawn under precautions to avoid infection, immediately strained and cooled, and packed in sterilized bottles which are kept at a temperature of not to exceed 50° F. until delivered to the consumer.

In submitting these suggestions your committee desires to add that in its opinion prompt action should be taken along the lines indicated in order to secure, at the earliest possible moment, a supply of wholesome milk for the infants of the District. It is believed that an effort in this direction should take precedence of the general effort to secure an improved quality of milk for all the citizens. Your committee realizes that milk of the character described above will cost more to produce, and should bring a higher price in the market than ordinary uncertified milk. At the same time it is hoped that the producers of milk of this kind will endeavor to keep the prices within the means of the ordinary citizen, while making a fair profit on their invested capital.

Your committee is of the opinion that Washington should take the lead among the cities of the country in the character of its milk supply, and it is believed that action of the kind suggested will secure in a short time beneficial results.

REPORT OF THE COMMITTEE ON THE CONTROL OF THE MILK SUPPLY FROM AN ADMINISTRATIVE STANDPOINT.

[Submitted to the conference May 15, 1907.]

The committee appointed to consider and report upon the supervision and control of the milk supply of the District of Columbia from an administrative standpoint, having considered the recommendations of the committee on the sanitary aspects of the milk supply referred to it, begs leave to submit the following recommendations:

1. That for the purpose of supervising on the dairy farm the production of milk, inspectors, in addition to the chief inspector hereinafter mentioned, be provided in the proportion of at least 1 for every 100 licensed dairy farms, and for the purpose of supervising the handling and sale of milk in and about the city the number of inspectors be not less than three, the exact duties and the limits of the jurisdiction of each inspector to be fixed by the chief inspector and the work of the inspectors to be supervised by the chief inspector appointed for that purpose, under direction of the health officer.

2. That all inspectors be selected because of their special fitness for the work that they are to perform, not less than one-half of the inspectors of dairy farms to be veterinary surgeons; appointments to be made by the Commissioners on the recommendation of the health officer, and removal to be at the discretion of the Commissioners.

3. That every inspector devote his entire time to the performance of his official duties.

4. That salaries be paid commensurate with the technical skill and the experience of the inspectors; in the case of the chief inspector to be not less than \$2,000, and in the case of the other inspectors not less than from \$1,600 to \$1,800 per annum, with traveling expenses.

5. That the health officer be empowered to suspend and to revoke summarily any license to produce or sell milk in the District, if the holder of such licenses violates any of the laws or regulations governing the production and sale of milk or the bringing of milk into the District, in such manner as in the judgment of the health

officer to endanger the health of persons consuming the milk produced, sold, or brought in by the holder of such permit.

6. That any authorized inspector in the service of the health department, duly charged with the inspection of places where milk is produced, handled, or sold, be empowered to suspend summarily, for a period not exceeding forty-eight hours, any license to produce or to sell milk in the District and any license to bring milk into the District if the holder of such license violates any of the laws or regulations governing the production and sale of milk or the bringing of milk into this jurisdiction, in such manner as in the judgment of such inspector to endanger the health of persons consuming the milk produced, sold, or brought in by the holder of such license: *Provided*, That any inspector who willfully fails in the proper discharge of his duty, or who knowingly makes any false report, or who willfully and maliciously and without probable cause, threatens to suspend or suspends the license of any producer or dealer in milk, shall be guilty of a misdemeanor punishable by a fine or by imprisonment or by both.

7. That in connection with the health department there be provided facilities for the making of such chemical and bacteriological analyses of milk, and of water from dairy farms and places where milk is handled and sold, as in the judgment of the health officer may be necessary.

8. That such additional clerical assistance be provided as may be required to meet the increased demands upon the clerical force of the health department that will result if these recommendations be adopted.

9. That whenever a sample of milk is collected for analysis, the inspector divide the sample into two parts, place each part in a proper container, and seal each such container with a proper seal, and then deliver one such sealed container to the vendor for such purpose as he may desire, the dividing, bottling, and sealing of the samples to be done in the presence of the vendor or his agent.

10. That every place where milk is sold be deemed a dairy for all purposes whatsoever.

11. That the Commissioners be empowered to make, on the recommendation of the health officer, all such regulations as may be necessary in their judgment to safeguard the milk supply of the District of Columbia.

W. F. MATTINGLY, *Chairman*.

[Cir. 114]